
DEVFEST
Android 2019
GDG Korea Android

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#DevFest

머신러닝을 이용한 Android 앱 자동화 테스트 방법

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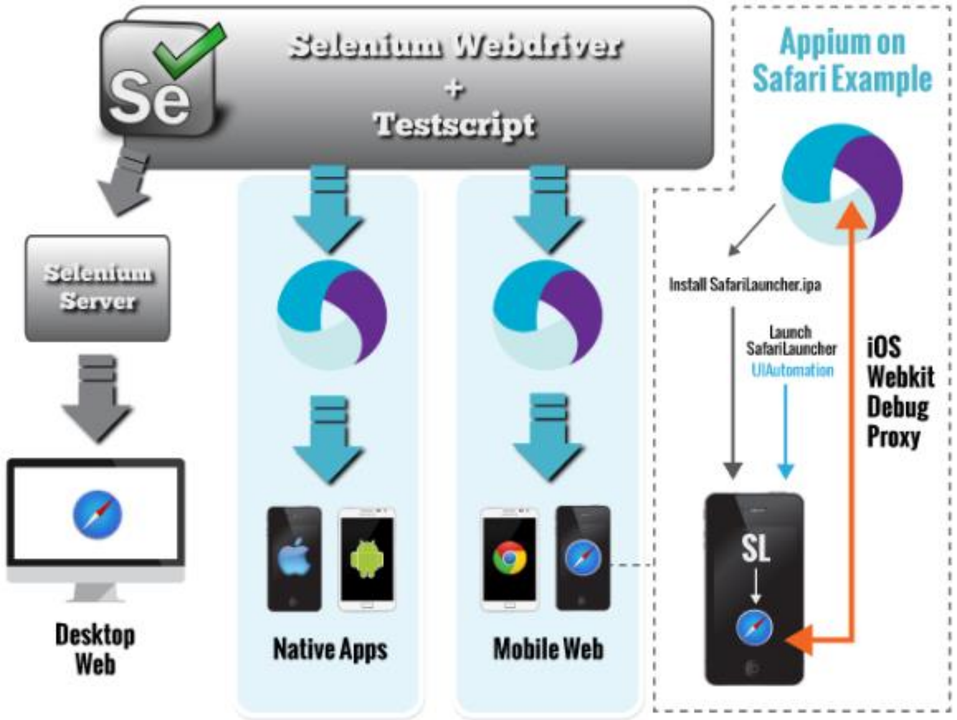
앱 테스트 방법들

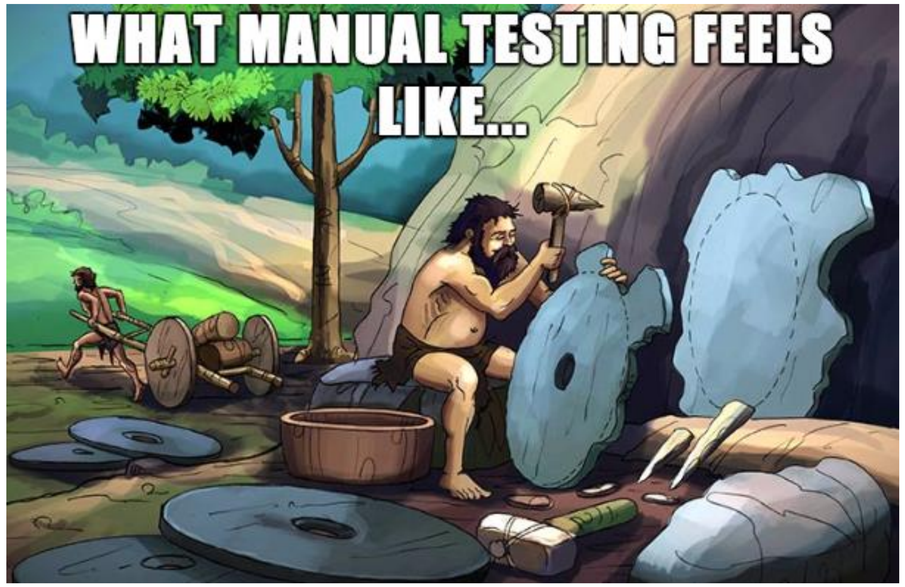
Selenium

selendroid
SELENIUM FOR ANDROID

appium



Manual Testing



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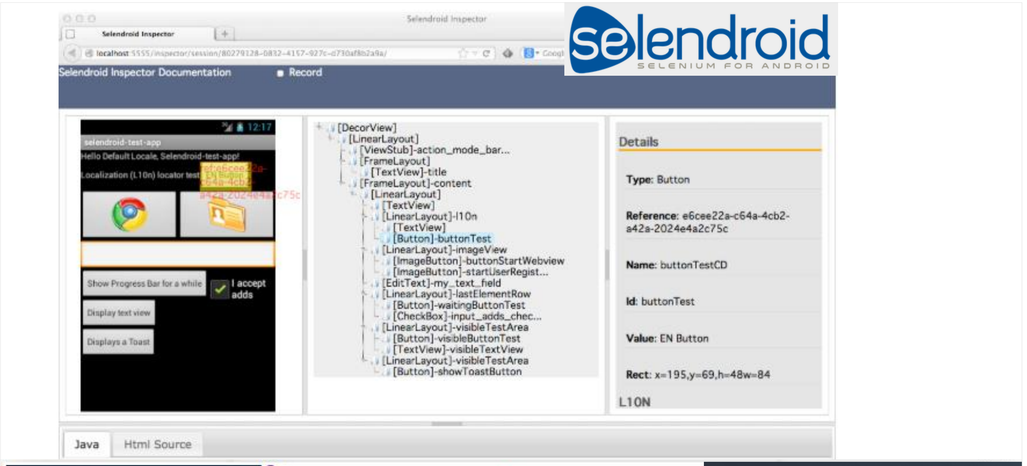
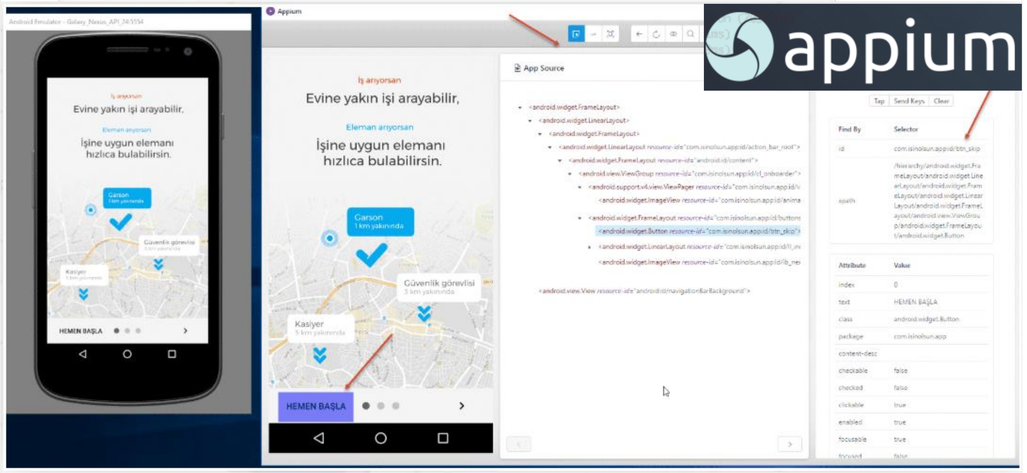
앱 자동화 테스트 과정

Element ID **확인** → Test Code **작성** → Test execution






```
@BeforeMethod
public void setup () throws MalformedURLException {
    DesiredCapabilities caps = new DesiredCapabilities();
    caps.setCapability("deviceName", "Galaxy Nexus API 24");
    caps.setCapability("udid", "emulator-5554"); //DeviceId from "adb devices" command
    caps.setCapability("platformName", "Android");
    caps.setCapability("platformVersion", "7.0");
    caps.setCapability("skipUnlock","true");
    caps.setCapability("appPackage", "com.isinolsun.app");
    caps.setCapability("appActivity","com.isinolsun.app.activities.SplashActivity");
    caps.setCapability("noReset","false");
    driver = new AndroidDriver<MobileElement>(new URL("http://127.0.0.1:4723/wd/hub"),caps);
    wait = new WebDriverWait(driver, 10);
}


@Test
public void basicTest () throws InterruptedException {
    //Click and pass Splash
    wait.until(ExpectedConditions.visibilityOfElementLocated
            (By.id("com.isinolsun.app:id/animation_view"))).click();

    //Click I am searching a job
    wait.until(ExpectedConditions.visibilityOfElementLocated
            (By.id("com.isinolsun.app:id/bluecollar_type_button"))).click();


    //Notification Allow
    if (driver.findElements(By.id("com.android.packageinstaller:id/permission_allow_button")).size()>0) {
        driver.findElements(By.id("com.android.packageinstaller:id/permission_allow_button")).get(0).click();
    }

    wait.until(ExpectedConditions.visibilityOfElementLocated
            (By.xpath(secondNewJob)));
}
```

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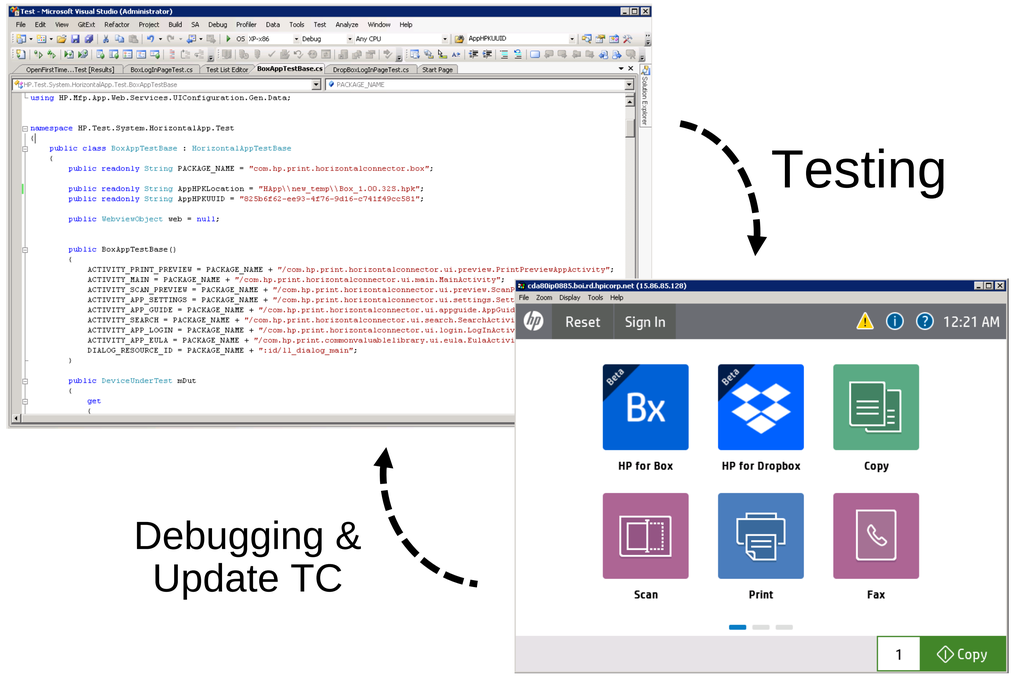
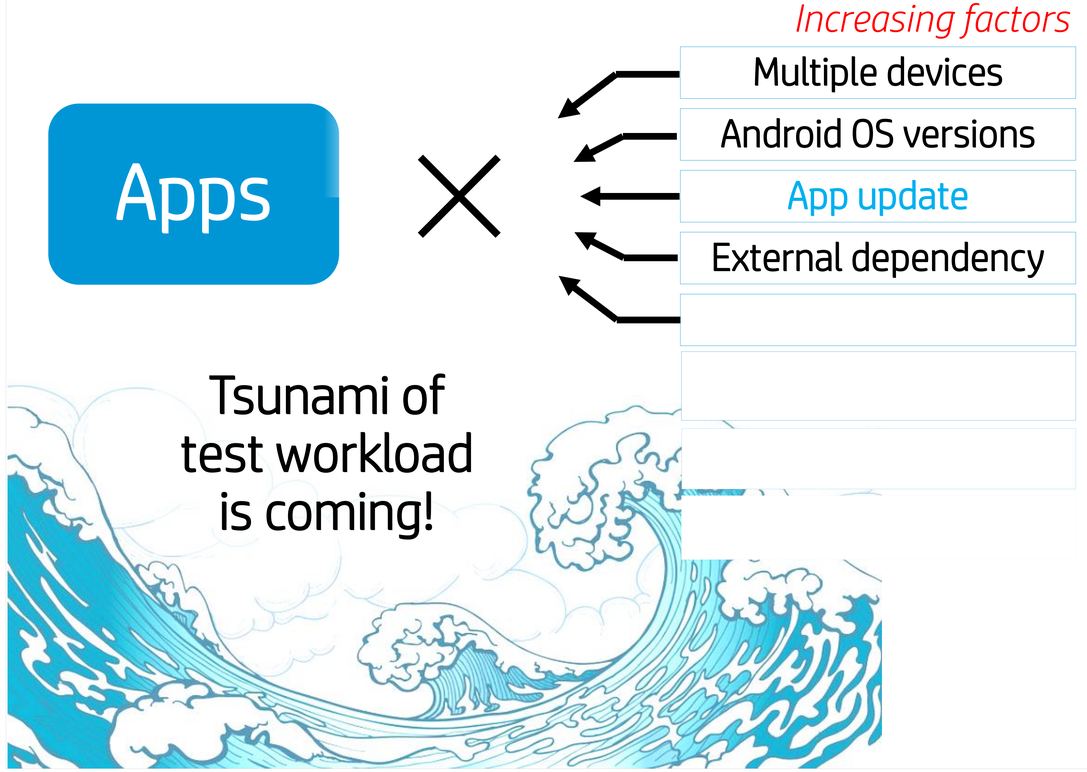
앱 자동화 테스트 문제점

Initial labor-intensive efforts



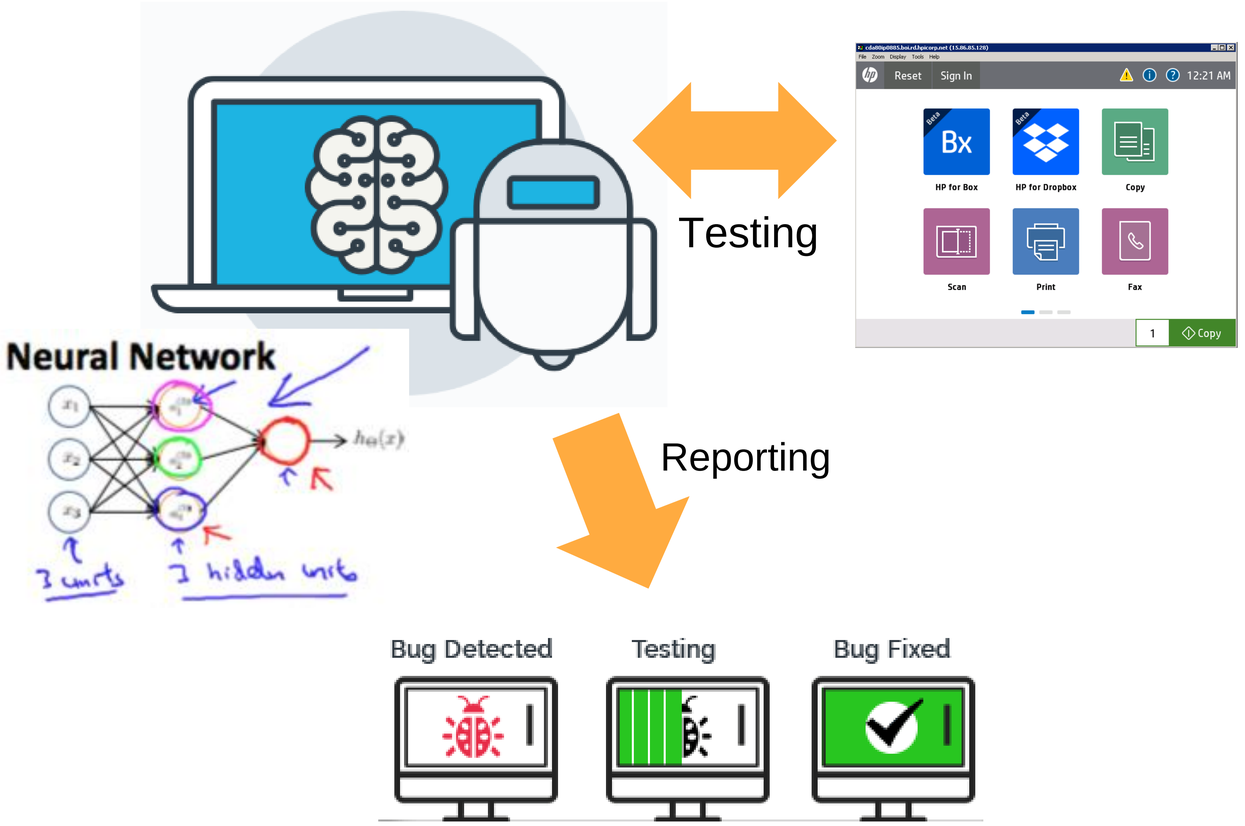
Huge maintenance efforts

- Too many factors ↑
- The number of test cases ↑



머신러닝을 이용한 앱 자동화 테스트

- Automation UI Testing using Machine Learning
- Auto constructing a training set
- Increase accuracy and coverage by Reinforcement Learning



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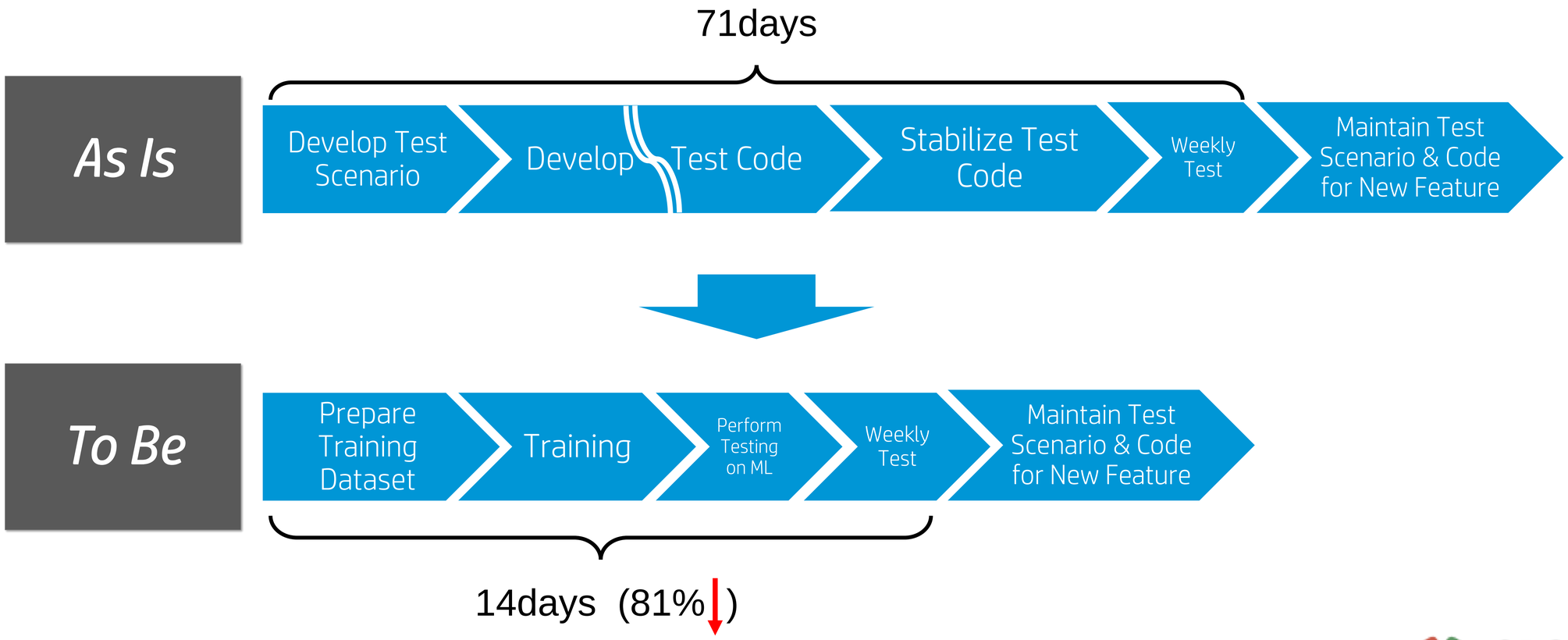
머신러닝 도입 후 예상 기대 효과



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개발 히스토리

- Phase 1
  - UI Test Framework Open Source 대상 분석 & 선정
  - 상용 앱에 대한 기본 테스트 진행 (Random Test)
  - Test Path Visualization 개발
  - Test Agent 개발

- Phase 2
  - Full Path Search from UI Test Framework
  - Activity Labeling
  - App Screen Classification & Regression
  - Test Path Search from Reinforcement Learning

- Phase 3 (In Progress)
  - Integrating to Real Test Env.

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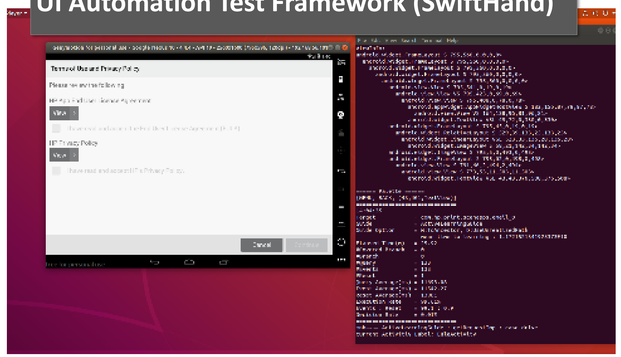
머신러닝 적용 Flow

Input Sequence Generator by ML (Supervised Learning)

② ③

UI Automation Test Framework (SwiftHand)



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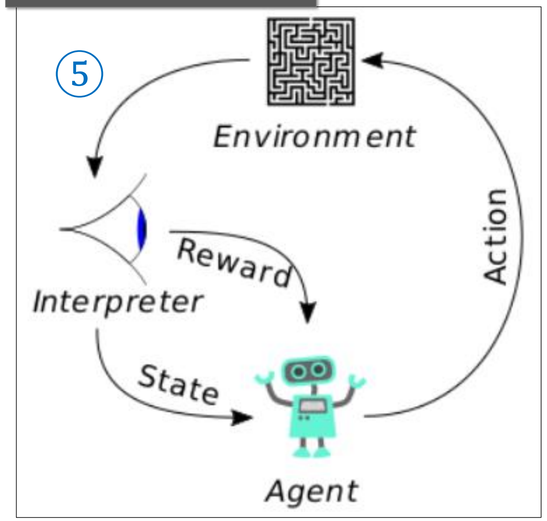
Reinforcement Learning



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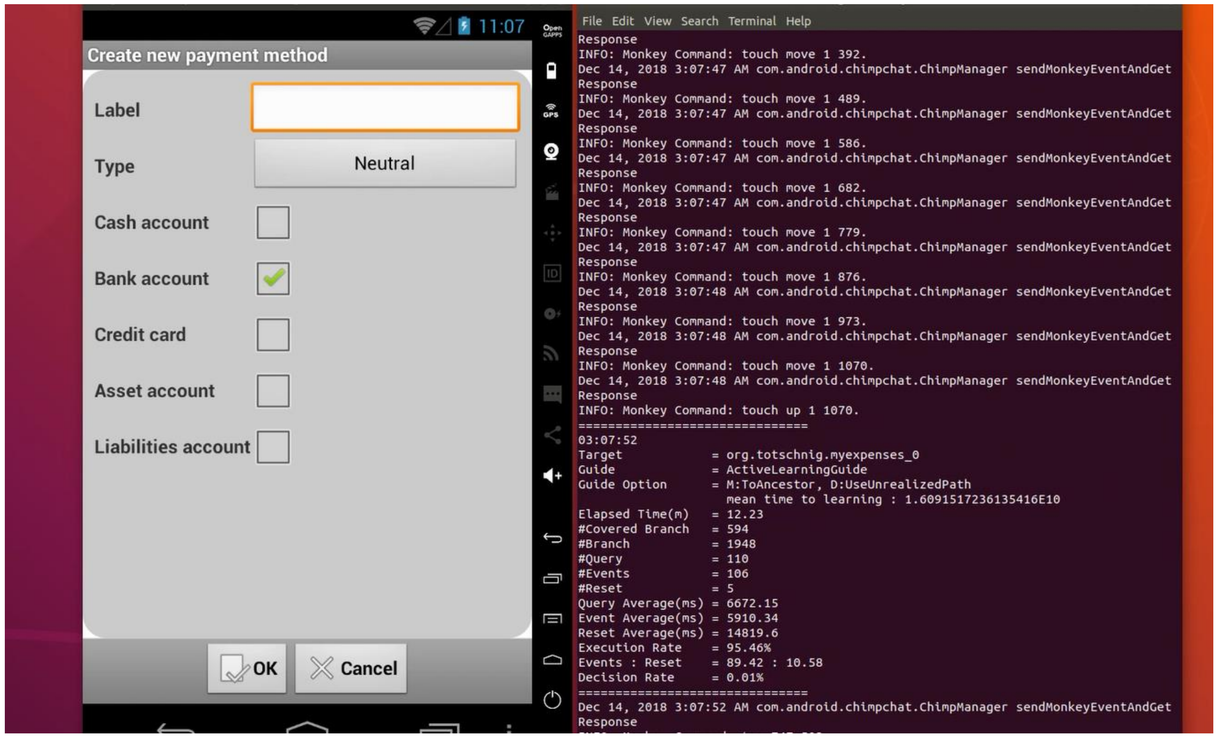
UI Automation Test Framework – SwiftHand (Open Source)

- 주요 기능
  - Random Test & Full Path Search
  - Searching user inputs
  - Code Coverage
  - Report
  - .dot graph 형태 결과 제공

- 동작 원리
  - Bytecode Instrumentation을 통해 원하는 기능을 가진 class 또는 method 추가 (asmdex lib)

- 개발 언어
  - Java, Scala



➔ **Multi dex 미 지원으로 적용 불가, Agent 방식으로 변경**

https://youtu.be/2VuzLN7ithQ

Before Inst.

SplashActivity.class

```
private void callNextActivity()
{
  Intent localIntent = new Intent(this, ScanPreviewAppActivity.class);
  localIntent.addFlags(67108864);
  localIntent.addFlags(65536);
  startActivity(localIntent);
  finish();
}

private void checkEula()
```

After Inst.

SplashActivity.class

```
/* Error */
private void callNextActivity()
{
  // Byte code:
  //   0: sipush 24106
  //   3: invokestatic 90   edu/berkeley/wtchoi/swift/driver/drone/Supervisor:logEnter  (S)V
  //   6: aload_0
  //   7: sipush 24106
  //   10: invokestatic 96  edu/berkeley/wtchoi/swift/driver/drone/Supervisor:logReceiver    (Ljava/lang/Object;S)V
  //   13: iconst_0
  //   14: sipush 24106
  //   17: invokestatic 48  edu/berkeley/wtchoi/swift/driver/drone/Supervisor:logDecisionPoint    (IS)V
  //   20: new 147     android/content/Intent
  //   23: astore_1
  //   24: bipush 8
  //   26: sipush 24106
  //   29: invokestatic 51  edu/berkeley/wtchoi/swift/driver/drone/Supervisor:logProgramPoint    (IS)V
  //   32: sipush 24106
  //   35: invokestatic 54  edu/berkeley/wtchoi/swift/driver/drone/Supervisor:logCall    (S)V
```

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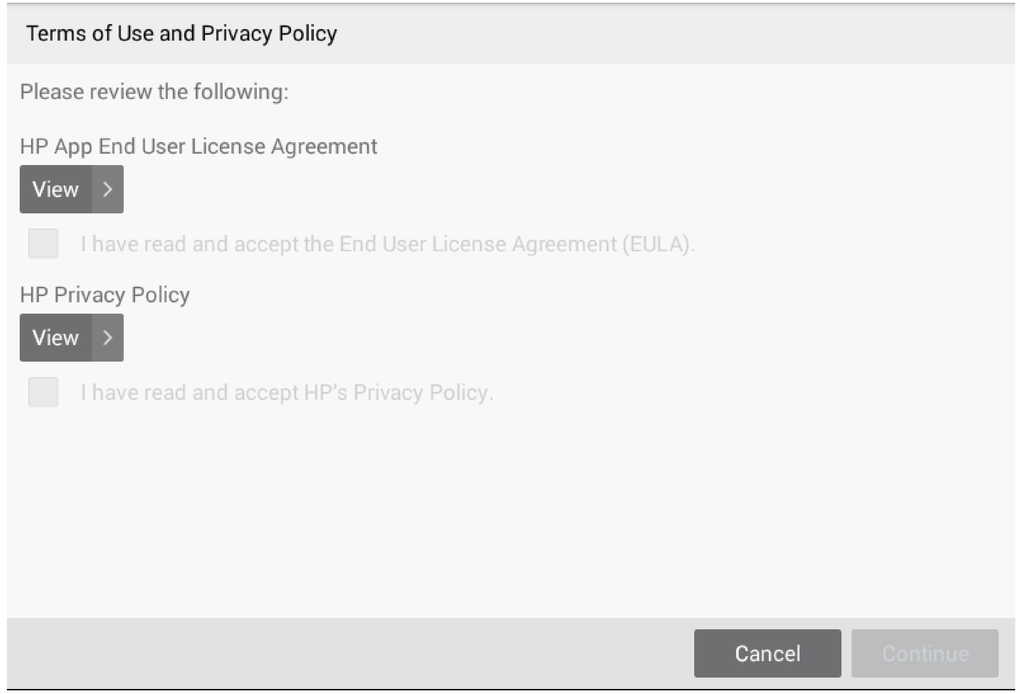
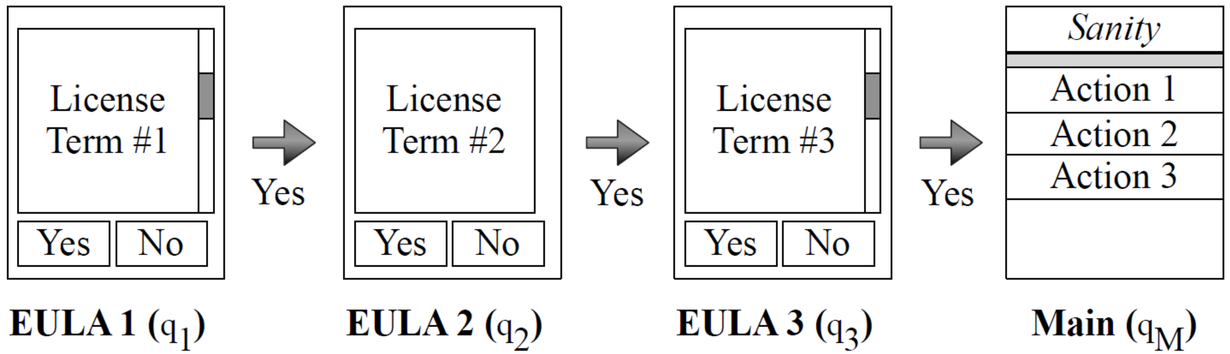
Input Sequence Generator by ML

- Random Test로 Full Path 찾을 때 이슈
  - 다양한 조합의 경우의 수 발생
  - 불필요한 Path
  - Oauth 로그인 페이지의 경우는?



Step 1: Gathering and Labeling Screen
Step 2: Active Learning & Training
Step 3: Input generation

➔ **EULA, Login 화면 등을 예측,**
Input Sequence 생성 후 UI Test Framework으로 전달



scikit-learn
Machine Learning in Python

Flask
web development, one drop at a time

Reinforcement Learning

적절한 **상태**와 **보상**의 설계가 강화학습 환경 제작의 핵심

https://gym.openai.com/

https://github.com/keras-rl/keras-rl

Reinforcement Learning – 환경 (Env.) 만들기

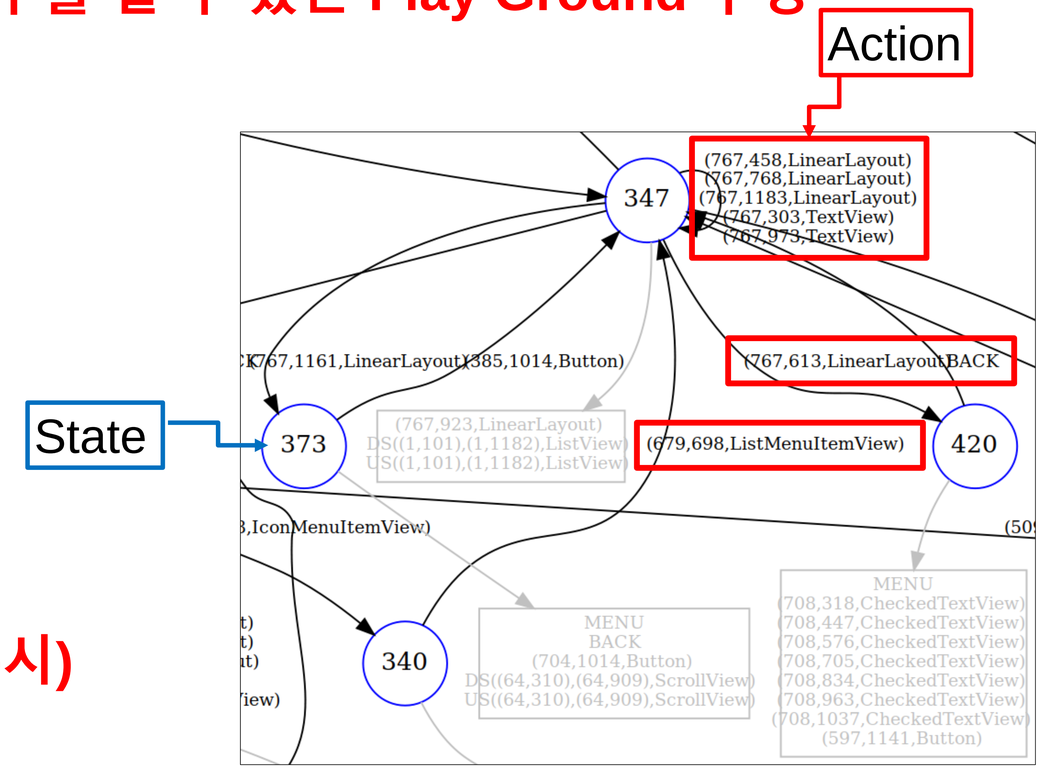
- 상태 (State)
  - 앱의 경우 현재 Screen이 현재 상태
  - Checkbox와 같이 동일 화면 Action 처리 필요
  - UI Test Framework에서 자동 State Labeling 활용
  - .dot graph data 전처리 ➔ **현재 상태와 다음 상태 모두를 알 수 있는 Play Ground 구성**

- 보상 (Reward)
  - 다음 상태 이동: +1
  - 이전 상태 이동: -1
  - 제자리 (Checkbox, Scroll 등): 0

- Action 정의
  - Activity 마다 발생 가능한 Action이 다름

  ➔ Action 일반화 어려움

  ➔ **Super set 활용 (현재 Activity에 없는 Action은 무시)**



Reinforcement Learning – 참조 링크

파이썬으로 나만의 강화학습 환경 만들기
(https://www.slideshare.net/ssuser163469/ss-78685946)

A.I Supermario with Reinforcement Learning - 1, 강화학습으로 인공지능 슈퍼마리오 만들기 튜토리얼 1
(https://www.youtube.com/watch?v=ydCrd9cDLsU)

Keras 빨리 훑어보기 (intro)
(https://www.slideshare.net/madvirus/keras-intro)

감사합니다.